Module 4: Mathematics

Materials Needed

- Copies of the VELS
- Handouts
- VCR and videotapes (optional)
- Flip chart, tape, and markers
- Art postcards, calendars or posters (optional)
- Blocks

Goals and Objectives

As a result of this module, participants will:	*Related Northern Lights Core Knowledge Areas*
Develop a deeper understanding of mathematics, including mathematical terminology	Teaching and Learning
Become intentional about play as a vehicle for developing children's understanding of mathematics	Child Development Teaching and Learning
Understand the learning goals and definitions related to young children and mathematics	Teaching and Learning
Understand how children's mathematical thinking changes over time	Child Development
Become familiar with the adult role in supporting children's mathematical development	Teaching and Learning
Become familiar with the way the environment supports children's mathematical understanding	Health and Safety
Increase their skills in observing and assessing how children develop mathematical concepts, processes and skills	Teaching and Learning
Become familiar with professional resources and research on children's mathematical development	Teaching and Learning Professionalism and Program Organization
Be able to describe ways to support children's mathematical development to others, including parents	Family and Community

Note ☞ Specific page references to the Mathematics domain in the Vermont Early Learning Standards in this module are noted as: "VELS" followed by the page number. For example, VELS Pg 20. Relevant pages for this module are 14-15, 27 and 30.

Module 4: Mathematics

Introduction and Opening Activity

1. Make sure participants and the instructor introduce themselves including pertinent information about their work and work settings.
2. Choose an opening activity from the options listed below:
    - Use *Handout 1: Where Do You Stand?* for an informal assessment of beliefs and attitudes about mathematics.
    - In pairs, do a simple assessment of mathematics understanding, using *Handout 2: How Many Ways to Solve 34 + 48?* or a similar activity.
    - Have participants reflect on the following quote by Marilyn Burns, and then share their thoughts with the group. Use *Handout 3: Marilyn Burns Quote,* if needed.

        > Otherwise well-educated adults, confident and successful in most aspects of their lives make easy confessions at dining tables, "I'm not good at math. I never was any good at math. I hate math!"

    - Use these questions to facilitate individual reflections: Do you know people like this? How do our past experiences with mathematics in school affect our attitudes toward mathematics with children? ZZZ this is number 3

Review the Standard and Domain

- The instructor should review the Mathematics section of VELS, pages 14-15. Take notice of the introduction; explanation of the domain; learning goals and definitions; examples; correlation to Vermont Frameworks and Head Start outcomes; role of the adult; and the role of the environment.
- In small groups or pairs, have participants cover up the examples column on page 14. Ask them to pick one learning goal and describe 2-3 examples they have seen of children's behavior or actions related to that goal. Uncover the examples column and discuss how their responses compared to the examples provided in the VELS.
- Invite group discussion on one of the following topics:
- How children's interest in mathematics is affected by adult's attitudes about math
- Mathematics in the context of children's lives
- The mathematics understanding required to get from your home to this workshop

The Development of Mathematical Thinking

This section serves as a basis of understanding how children develop mathematical thinking as well as a refresher for adults in the terminology and operations of mathematics. Refer to Chapter 6 in Copley, J. ed. <u>Mathematics in the early years.</u> Reston, VA: National Council of Teachers of Mathematics and National Association for the Education of Young Children, 1999 for more information and relevant vignettes.

Instructors should use the following key points to develop a mini-lecture on the development of mathematical thinking.

In the preschool years, children develop mathematical understanding through:

- The appearance of things: ***** looks like it is less than * * * * *
- Their experience with things: having learned that both sets above contain five stars, they know to count the stars before making assumptions based on appearance
- Formal knowledge: school and adult-led instruction

Components of Formal Knowledge

1. Numbers and Operations
Children show interest and curiosity in counting and grouping objects and numbers.

Counting Concepts and Skills

Oral Counting–Stating the numbers in the correct order; counting patterns: learning the patterns of number order:

- Single digit sequence of one-nine
- Transitions are signaled by the nine
- Transition terms for the new series (twenty, thirty, etc.)
- Rules for generating the series (numbers after 20 are the word *twenty* plus the name of the single digits)
- Exceptions to the rules (the teens, fifteen)

1:1 Correspondence–Matching the number word to items tagged

- Placing an object in a designated space (pegs in a pegboard, cup on a saucer)
- Matching pairs of objects (mittens, shoes, socks)
- Pairing objects to other objects (lines up brushes to paint pots, cups to chairs around the snack table, dealing one card per person)
- Comparing objects in two sets (who has more blocks, are there more girls or boys in the classroom?)

Object Counting–Using only one number word per object you want to count

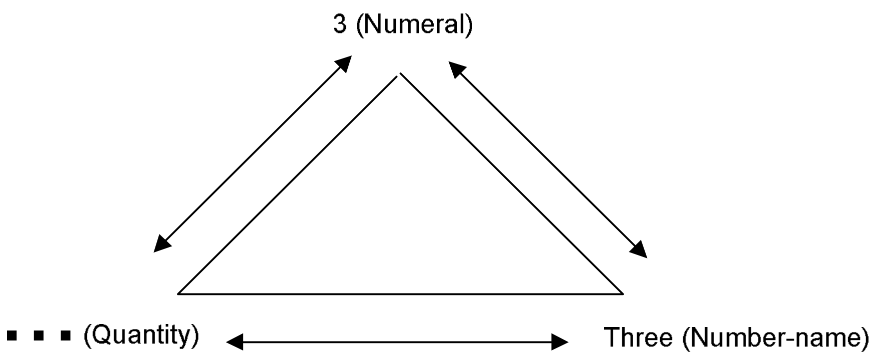
- *1:1 correspondence counting*: matching number-words to objects while counting (not necessarily in sequence).
- *Cardinality*: when counting a set of objects, the last number said tells you how many objects are in the set.
- *Counting out sets*: counting out a specified number of objects from a pile of items.
- *Order irrelevance*: counting can be done in any order (left to right, horizontally, right to left) and the amount stays the same.

Activity: Children Counting

1. Depending on the size of the group, choose to do this in pairs, small groups or with the group as a whole.
2. Have participants make a list of all the opportunities they can think of to observe children counting. Where and when might they observe children counting? How teachers encourage children to count?

Number Concepts and Skills
The number is the concept; the numeral is the symbol.

The Numeracy Triangle Three ways to recognize and represent numbers (see Copley, J. ed. Mathematics in the early years. Reston, VA: National Council of Teachers of Mathematics and National Association for the Education of Young Children, 1999: 131)



Subitizing Instant recognition of the quantity of a small group of objects – knowing * * * are three stars without having to count them. Subitizing is evident through objects, finger patterns (holding up fingers to represent a quantity), and dot patters (as on dice).

Operations Using number concepts to solve problems in a context

Addition–joining sets or combining quantities

Subtraction–taking sets apart, separating

Multiplication–adding multiple equal sets of objects

Division–splitting sets; giving each their "fair share"

Activity: Empty Your Pockets

1. In small groups, ask people to pull three objects out of their purse/pocket/briefcase and put them in the middle of the table.
2. Do as many operations as you can with these objects. Come up with your own activities that demonstrate: Subitizing, The Numeracy Triangle, and Operations. How might children use objects in play to discover these concepts?

2. Geometry and Spatial Sense

Choose one of the following activities:

Activity: Shape Hunt

1. In small groups, assign people a section of the room or building to go on a shape hunt.
2. Have them make a list of every shape they find, using all the shape words they know. Return to the large group and report out. Are there any shape names you didn't know or remember?

Activity: Art and Architecture

1. Mathematics can be defined as the study of patterns and relationships. This definition could also apply to art, architecture, design and crafts.
2. Collect postcards, calendars or other visual art of buildings or architecture, textures, plants, tiles, fabrics, etc.
3. In small groups, have people explore the artwork and notice the patterns and shapes, identifying the names of them if possible.

Fun facts about shapes

- Humans prefer closed, symmetric shapes
- Shapes come in many different proportions and orientations.
- Shapes consist of lines, points and angles
- Squares are rectangles
- Shape categories include polygons, ellipses, quadrilaterals
- Polygon—two dimensional closed figure with four sides
- Shapes have two or three-dimensions; two-dimensional shapes have one face, three-dimensional shapes have multiple faces

Spatial Sense includes

- Orientation (where you are and how to get around)
- Position (on/off; top/bottom; under/over)

- Direction (forward, backward, to the side)
- Distance (how far/close, how long/short)

Activity: Stack It

1. Using 6-10 blocks of assorted shapes and sizes, have people experiment with different ways to stack blocks. Try to arrange them so that all blocks are used to make the smallest shape possible, and the largest shape possible. Try to arrange them so that the unique shape face is visible.
2. Make a list of every shape word children use in play and conversation.

Many mathematics activities for young children use mainly two-dimensional shapes. Including both two- and three-dimensional materials help children identify the differences and see the relationship between them. The use of a variety of three-dimensional objects and blocks provide inviting, concrete, yet complex experiences for shape investigation. When children build with three-dimensional, modular materials they change the positions of both the materials and themselves in a physical space where their perspective is also changing.

3. Patterns and Measurement
Children show an interest in recognizing, creating, and predicting patterns; comparing objects; and measuring time and quantity.

Patterns	These can be repeating *** _ * _ * _** or growing *** ** *** **** ******* First, children identify similarities and differences between elements of a pattern. Then, they predict what will come next
Measurement	Includes integration and application of number, shape, spatial concepts. Measurement is the assignment of a numerical value to an attribute of an object. Measurement is a practical, real-life activity that connects to other areas of mathematics such as number and operations, and geometric ideas. Length/height, weight/capacity, time are things that can be measured.
Tools for measurement	What tools do you use with children? Conventional tools–rulers, scales, thermometers Invented tools–hands, feet, books, etc.

What Does Mathematics Look Like?

What does mathematics look like and how might teachers observe it in young children? Play is the first learning goal in the mathematics domain of VELS. While children are “natural mathematicians”, and much of their play involves mathematics concepts, teachers must be keen observers of children’s play in order to understand what they are learning as well as what their misconceptions are. Through observing children's mathematics play, teachers will know how to ask questions, make suggestions and offer help that extend and deepen children's mathematics knowledge and skills. This is an example of using intentionality in teaching.

Choose one of the following activities:

Activity: Where is the Math Here?

1. Show a videotape of children at play, such as "The Long Jump: A video analysis of early education in Reggio Emilia, Italy" narrated by George Forman; "Thinking Big: Extending emergent curriculum projects" or one selected by the instructor.
2. Ask participants to list the mathematics concepts evident in the children's play. Ask them to notice any or all of the following:
   - How other children contributed or detracted from the exploration of mathematics concepts? (the social context);
   - What an adult said or did that contributed or detracted from their exploration? (the adult role);
   - How the materials and space contributed or detracted from their exploration? (the role of the environment)

Activity: Building Towers Case Study

1. Use Handout 4: The Building Towers Scenario as a guide for this activity.

Reflecting on Mathematics

Have participants reflect on the Mathematics domain using the following independent writing activities:

- Use *Handout 5: Twelve Myths About Math*. Have participants pick one or two myths they identify with, and debunk those myths using information and experiences from this workshop.
- Describe a feature of their own mathematics instruction as a child or adult. What do they remember, and how do they think their early experiences with mathematics influence their attitude and teaching practices today?

The Adult's Role in Supporting this Domain

Adults, teachers, and parents support children's mathematics development in many ways. Using what the group has learned about young children and math, brainstorm a big list of ideas about exactly what adults do to promote mathematical thinking and understanding in children. Make sure the list includes the ideas below:

- Having self-awareness about ourselves as mathematicians ("awakening the genius in your classroom and the mathematician in yourself")
- Possessing a positive attitude and curiosity about math, and conveying both to children

- Gaining knowledge and skill with mathematics materials, concepts and experiences to offer children
- Understanding how children think about mathematics and their common misconceptions about mathematics concepts
- Observing children to understand their interests and abilities
- Reflecting on and interpreting observations of children
- Using observations and reflections to make decisions about how to enhance individual children's learning. This could be as simple as asking a question, or complex as developing a unit of study
- Using correct vocabulary when commenting or providing direct instruction
- Helping children extend their thinking by making comments, asking questions, noticing comparisons
- Supporting children to further their knowledge, interest and understanding
- Using parents as partners, and helping parents understand their roles in supporting children's mathematical thinking

Once the list is complete, ask participants to reflect on thinking about a time when they had a success with mathematics in the classroom. What happened? Why was it successful?

The Role of the Environment in Supporting this Domain

Confirm that everyone is defining "environment" as the space (both inside and outside), materials and equipment, room arrangement, routines and schedule.

Consider this statement:

> "Teachers are…the architects of the environment…they must load the environment so that children bump into interesting mathematics at every turn."

Quote from Copley, J. ed. Mathematics in the early years. Reston, VA: National Council of Teachers of Mathematics and National Association for the Education of Young Children, 1999. (Chapter 4 "Ready to Learn: Developing young children's mathematical powers")

How can you load your home or classroom and playground environment so that children bump into mathematics in meaningful ways? Refer to the list in VELS Pg. 15, and add your own ideas. Or, use the Sandra Stone cartoon in the Supplemental Material section at the end of the module, and write down a few ideas about how to interject mathematics into each area of the room. Or, use a children's book from the children's annotated bibliography to demonstrate how mathematical thinking is inspired by quality children's literature.

The characteristics of optimal environments for supporting mathematics understanding and thinking:

- They are organized and logical
- They are equipped with many kinds of materials

- They display documentation of children's mathematics learning through charts, photographs with captions, and other displays of children's work
- They include opportunities for children to share mathematical discoveries
- They provide clear expectations for use of materials, how and where to put them away, what an area looks like when it is cleaned up (organized), and what a finished product is

Reflecting on the Role of the Adult and the Environment

Have participants complete a reflective writing activity that includes thinking about their past mathematics instructors and learning.

- What/who affected you the most?
- What would you like to emulate?
- What would you like to avoid?
- Where did your learning take place?
- How did the environment or setting influence the kind of learning experience it was for you?

Putting it All Together

The instructor should choose from among the following activities to integrate the information covered in this module.

- **Debating Mathematics:** Set up debate teams. Debate a topic related to early mathematics learning. See *Handout 6: Debating Mathematics*.
    - ? Children need teacher-directed activities to develop their understanding of mathematics concepts because they will not learn this through play.
    - ? Mathematical abilities are genetically predetermined; you are either a born mathematician or destined to struggle with numbers.
    - ? If you had good mathematics teachers as a child, you are a step ahead of those who didn't when it comes to providing rich and inspiring mathematics learning for young children today.
- **Reporter Interviews:** A reporter comes to interview you about why children are learning mathematics in preschool. See *Handout 7: Newspaper Interview*
- **Note to Myself:** On a blank sheet of paper have participants list ten things they will do next week to enhance and support mathematics understanding with their children.
- **Top 10 Reasons to Teach Mathematics to Preschoolers:** Break into small groups and make a list of the top ten reasons to teach mathematics to preschoolers. Groups share and combine their lists with one other group, then present to the whole group.

Conclusion

Instructor should summarize the key points of this module including key points such as:

- Adult attitudes about mathematics affect children's perceptions and learning
- Many adults need to refresh their understanding of mathematical concepts in order to provide meaningful learning opportunities for children
- While children learn about mathematics through play, teachers should be intentional about what, why and how they provide play opportunities and extend children's play to make the most out of these activities

Handout 1: Where Do You Stand?

Materials

None

Room Arrangement

Open space; big enough for participants to stand and form a line from one end of the room to another

Time

10 minutes

Goal

- To have participants become familiar with and personally relate to the topics covered in this module.

Instructor

1. Have participants stand up and move to one side of the room.
2. Tell the group that they are going to form a human continuum, responding as the instructor reads *Handout 5: The Twelve Myths about Math*.
3. Point to the side of the room you want participants to stand if they agree or disagree with the statement (myth). Let them know they may position themselves at any place in the middle or either extreme.
4. Randomly pick individuals to ask them to describe why they put themselves in that spot.

Note ☞ Close this activity by acknowledging the diversity in the group, or that diversity exists outside this group. We acquire attitudes about mathematics based on our experiences in school and home environments. As adults we can change our attitudes and perceptions about ourselves and math. We need to appreciate our influence as role models for children when it comes to learning in general, and specifically in mathematics.

Handout 2: How Many Ways Can You Solve 34 + 48

Materials

None

Room Arrangement

Participants should have room to sit in pairs

Time

15 minutes

Goals

- To think "outside the box" of our own educational experiences of learning mathematics
- To experience solving an equation using mental mathematics methods

Instructor

1. Prior to presenting this activity, the instructor should familiarize him/herself with different ways to solve the equation using the background information on the following pages.
2. Introduce this activity as an opportunity to think outside the box that our own educational experiences have created for us. For many of us mathematics is made up of procedures, facts and formulas we needed to memorize. If you were unable to memorize them, you were left struggling. With the following task, you now have the opportunity to break out of that box and try something new.
3. Ask participants to solve an equation using only mental methods, no paper or pencils, just in your head. If possible refrain from using the traditional method of solving the equation. Look closely at the numbers before you begin and try to think of a method that is quick and efficient. Once you've solved it, try to think of another way it can be solved.
4. Present the equation 34 + 48 = on chart paper or on overhead. Make certain the equation is presented horizontally, not in the traditional vertical format.
5. Give everyone a few minutes to solve the equation. Ask for volunteers to orally share their method of solving. Record their solutions on the chart paper or overhead, record as many different strategies as possible, even if they are only slight variations of previous ones. Lead a discussion with the following points in mind:
    - Multiple and non-traditional strategies
    - Demonstration of number sense
    - Developing a deeper understanding of numbers, numerical relationships and operations
    - Importance of learning from one another by listening to each other's strategies.

Background Knowledge

Composing and decomposing methods

Writing out the steps in this process makes this method seems tedious; however, individuals who mentally decompose numbers to add do so fluently and accurately. Often individuals begin to cluster the steps together, increasing their fluency.

34 + 48 =

34 = 30 + 4

48 = 40 + 8

30 + 40 = 70

4 + 8 = 12, because

2 + 2 = 4 so

8 + 2 = 10 and

10 + 2 = 12

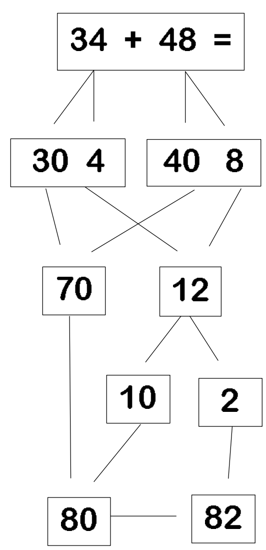
70 + 12 =

70 + 10 + 2 =

70 + 10 = 80

80 + 2 = 82

Here is another representation of the same method:



Combining strategies
Many individuals will combine strategies-counting by tens and then composing and decomposing:

Start at **34** and count on **4** tens…**34, 44, 54, 64, 74**.

Then **6** to get to **80** and **2** more to **82**. (Because you can break **8** into **6** and **2**.)

Using landmarks
Some individuals will solve this by thinking about **50**. **48** is close to **50**. If you take **2** from **34** and add it to **48**, you have this equation **32 + 50** which can easily be solved by thinking **30 + 50 + 2 = 82.** This may be represented as follows:

$$\underbrace{34 + 48}_{2} = \qquad 32 + 50 = \qquad 30 + 2 + 50 = \qquad 80 + 2 = 82$$

Note ☞ When representing individual's strategies, please be careful to use the "equals" sign correctly. There is a tendency to string equations together. This is an incorrect use of the "equals" sign:

34 + 48 = 30 + 40 = 70 + 12 = 70 + 10 = 80 + 2 = 82

With the definition of the equals sign meaning the "same as", the above equation is incorrect. Writing a new equation for each step will eliminate the incorrect use of the "equals" sign.

Other methods
May include use of manipulatives such as base-ten materials, hundreds charts, number lines, fingers, etc.

Traditional algorithm

$$\begin{array}{r} {}^{1} \\ 34 \\ +\,48 \\ \hline 82 \end{array}$$

Research says that when setting up an equation into columns, most individual no longer see each number as a whole, but rather individual digits. If the procedure isn't followed precisely, errors may occur. Students may incorrectly complete the task like the example below because they may not think of **34** as **30 + 4**, and **48** as **40 + 8**, they may not notice that **812** is not a reasonable solution.

$$\begin{array}{r} 34 \\ +\,48 \\ \hline 812 \end{array}$$

Inventing or constructing non-traditional algorithms support a deeper understanding of number.

Handout 3: Marilyn Burns Quote

Otherwise well-educated adults confident and successful in most aspects of their lives make easy confessions at dining tables, "I'm not good at math. I never was any good at math. I hate math!"

Handout 4: Block Tower Scenarios–A Case Study

Mrs. C had decided she was going to be more intentional about the mathematics she wanted her students to explore while playing at the block center. She presented a task that involved students working in pairs to solve a problem in hopes that her students would engage in discourse about their ideas and strategies.

Mrs. C presented that task as follows: I would like each of you to work with a partner at the block center today. Together, you and your partner will choose six blocks to build the tallest tower you can. You can choose any six blocks you would like, but remember, I'd like you to build the tallest tower you can.

Mrs. C thought that this activity would promote discussion among her students which would include choice of blocks, orientation of those blocks and how that would affect the height of the tower. She was also prepared with questions that she would ask to extend her students' thinking such as, "Is that the tallest tower you can build? How do you know? Can you build another tower using six blocks? Is it taller than the first? Why or why not? Is there anything you can do with the blocks in this tower to make it even taller?" Again these questions were intended to help guide students in discovering that the choice of blocks and the orientation of those blocks may change the outcome. Mrs. C had a focused objective and was well prepared to facilitate and extend her students thinking if needed.

Here are two scenarios that occurred during the day.

Scenario 1

Andrew and Thomas were working together to build a tower. When Mrs. C approached she realized that they were adding more than six blocks. She reminded them of the task.

Mrs. C: *"How many blocks can you use in this tower?."*

Andrew & Thomas: *"Six."*

Mrs. C: *"How many blocks are in your tower?"*

Thomas counted pointing first at the bottom block and counting upward.

Thomas: *"One, two, three…eleven."*

As Mrs. C observed, she noticed that Thomas' count was not accurate. He was not demonstrating one-to-one correspondence.

Andrew: *"That's not right…there's one, two, three…eight. There are eight blocks."*

Andrew counted with an accurate one-to-one match. Thomas scrunched up his face and stared at Andrew.

Mrs. C: *"Andrew says there are eight blocks and you said there are eleven, what do you think of that?"*

Thomas counted again, more slowly this time.

Thomas: *"One, two three…ten…eleven. I'm right!"*

Thomas again did not demonstrate one-to-one correspondence. However, when he reached the top and was on ten he hesitated and then pointed to the top face of the top block and said, "eleven!"

Andrew then dismantled the tower and used a traditional grouping method for keeping track of the count--sliding counted blocks to the left--to show Thomas that there were really eight. But, it wasn't until Thomas mirrored Andrew's actions that he believed him.

Mrs. C observations lead her to learn a great deal about her students. What she learned was not what she had intended to learn, but it was valuable just the same.

- What does Thomas know? What evidence in the above scenario supports this knowledge? What would your next steps for Thomas?
- Answer the same questions for Andrew.

Scenario 2
As Mrs. C approached Peter and Jane she noticed that there were using six blocks, but the building they created was not a tower in which all blocks were stacked on top of one another. The blocks were clustered together with three along the bottom and the others stacked on top.

Mrs. C: *"That's a very interesting tower. How many blocks did you use?"*

Jane & Peter: *"Six."*

Mrs. C: *"Do you remember what your task is today?"*

Jane: *"To build a tall tower?"*

Mrs. C: *"Is that a tall tower?"*

Jane: *"Yes."*

Mrs. C: *"Is there anyway you can make that a taller tower?"*

Peter: *"Yes…you can put these on top."*

He took the two of the three from along the bottom and placed them on top.

Mrs. C: *"What do you think Jane. Is that taller than the first one?"*

Jane: *"Yes."*

Mrs. C: *"How do you know?"*

Jane: *"Because, it has more on the top."*

Mrs. C: *"Do you think you can choose six new blocks and make an even taller tower?"*

Jane & Peter: *"Sure."*

Jane and Peter began to collect six new blocks. Mrs. C moved to another group while they built. When Peter and Jane had finished their new tower, she returned.

Peter: *"See we built a taller tower."*

Mrs. C: *"How do you know this is a taller tower?"*

Peter: *"Because it is higher than this one."*

Mrs. C:	*"So higher means taller."*
Peter:	*"Yeah."*
Mrs. C:	*"Jane, how many blocks are in this new tower?"*
Jane:	*"Six."*
Mrs. C:	*"How many blocks were in the first tower?"*
Jane:	*"Six."*
Mrs. C:	*"If they both have six blocks, how can one be taller than the other?"*
Jane:	*"Because some of these blocks are longer."*
Mrs. C:	*"Is there anyway you can make this tower ever taller?"*
Peter:	*"Yes, you can turn this block this way."*

One of the blocks in the middle of the tower had been placed horizontally. Peter turned it vertically, making the tower taller.

Peter:	*"See."*
Mrs. C:	*"So, turning blocks can make your tower taller. Do you think you can choose six blocks to make an even taller tower?"*

Peter and Jane continued to build towers using different blocks and exploring with their orientation.

Mrs. C observations again lead her to learn a great deal about her students.

- What do Peter and Jane know?
- What evidence in the above scenario supports this knowledge?
- What would your next steps be for Peter and Jane?

Handout 5: Twelve Myths about Math

1. **Men Are Better In Math Than Women.**
   Research has failed to show any difference between men and women in mathematical ability. Men are reluctant to admit they have problems so they express difficulty with math by saying, "I could do it if I tried." Women are often too ready to admit inadequacy and say, "I just can't do math."

2. **Math Requires Logic, Not Intuition.**
   Few people are aware that intuition is the cornerstone of doing math and solving problems. Mathematicians always think intuitively first. Everyone has mathematical intuition; they just have not learned to use or trust it. It is amazing how often the first idea you come up with turns out to be correct.

3. **Math Is Not Creative.**
   Creativity is as central to math as it is to art, literature, and music. The act of creation involves diametrical opposites–working intensely and relaxing, the frustration of failure and elation of discovery, satisfaction of seeing all the pieces fit together. It requires imagination, intellect, intuition, and aesthetic about the rightness of things.

4. **You Must Always Know How You Got The Answer.**
   Getting the answer to a problem and knowing how the answer was derived are independent processes. If you are consistently right, then you know how to do the problem. There is no need to explain it.

5. **There Is A Best Way To Do Math Problems.**
   A math problem may be solved by a variety of methods which express individuality and originality, but there is no best way. New and interesting techniques for doing all levels of math, from arithmetic to calculus, have been discovered by students. The way math is done is very individual and personal and the best method is the one which you feel most comfortable.

6. **It's Always Important To Get The Answer Exactly Right.**
   The ability to obtain approximate answer is often more important than getting exact answers. Feeling about the importance of the answer often are a reversion to early school years when arithmetic was taught as a feeling that you were "good" when you got the right answer and "bad" when you did not.

7. **It's Bad To Count On Your Fingers.**
   There is nothing wrong with counting on fingers as an aid to doing arithmetic. Counting on fingers actually indicates an understanding of arithmetic-more understanding than if everything were memorized.

8. **Math Do Problems Quickly, In Their Heads.**
   Solving new problems or learning new material is always difficult and time consuming. The only problems mathematicians do quickly are those they have solved before. Speed is not a measure of ability. It is the result of experience and practice.

9. **Math Requires A Good Memory.**
   Knowing math means that concepts make sense to you and rules and formulas seem natural. This kind of knowledge cannot be gained through rote memorization.

10. **Math Is Done By Working Intensely Until The Problem Is Solved.**
    Solving problems requires both resting and working intensely. Going away from a problem and later returning to it allows your mind time to assimilate ideas and develop new ones. Often, upon coming back to a problem a new insight is experienced which unlocks the solution.

11. **Some People Have A "Math Mind" And Some Don't.**
    Belief in myths about how math is done leads to a complete lack of self-confidence. But it is self-confidence that is one of the most important determining factors in mathematical performance. We have yet to encounter anyone who could not attain his or her goals once the emotional blocks were removed.

12. **There Is A Magic Key To Doing Math.**
    There is no formula, rule, or general guideline which will suddenly unlock the mysteries of math. If there is a key to doing math, it is in overcoming anxiety about the subject and in using the same skills you use to do everything else.

From Mind Over Math. New York, McGraw-Hill: 1979. 30-43. List downloaded from www.swt.edu/slac/math/skills/12Myths.html

Handout 6: Debating Mathematics

Materials

None

Room Arrangement

Teams face each other seated at tables

Time

20 minutes

Goal

To apply the learning in this module by creating arguments responding to debate topics.

Instructor

1. Form participants into teams of 4-5 people.
2. Have each team select a topic from the list below. Assure participants that this isn't a technical debate, but the goal is to represent a point of view and back it up with facts, experiences, information or research that would prove your point.
    - Children need teacher-directed activities to develop their understanding of mathematics concepts because they will not learn this through play.
    - Mathematical abilities are genetically predetermined; you are either a born mathematician or destined to struggle with numbers
    - If you had good mathematics teachers as a child, you are a step ahead of those who didn't when it comes to providing rich and inspiring mathematics learning for young children today.

Note

Assign teams a position either in agreement or disagreement with the statement. Each member of the team should have at least one point to make that represents the argument. The instructor can choose whether to have simultaneous debates taking place, or to have one debate at a time.

If having one debate at a time, assign remaining participants the role of observers.

If having simultaneous debates, circulate among the groups to make sure they stay on task and to answer questions or make suggestions to get them started. Have groups report back.

Handout 7: Newspaper Interview

Materials

None

Room Arrangement

Small group seating

Time

10 minutes

Goal

To apply learning in this module by presenting information about the importance of mathematics for young children

Instructor

- Separate the participants into pairs.
- Have each pair select one person to be the reporter and one to be the person interviewed.
- The instructor sets the stage by saying, " A reporter wants to do an article in the local newspaper about children's early mathematics learning. You have agreed to be interviewed because of your recent attendance at an early childhood mathematics conference."
- After each pair has worked independently, have the participants share highlights from their interviews.

Note ☞ Give each pair a few minutes to plan for this interview. The reporter should jot down some relevant and informed questions. Make sure the reporters understand their job is to ask intelligent questions, not questions that a true reporter might ask about a topic of which they have little knowledge. Make sure the interviewees understand it is their job to convey information about the what, where, when, how and why of mathematics for young children.

Mathematics Professional Resources

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Dodge, D.T., L.J. Colker, & C. Heroman. The creative curriculum for preschool, 4th edition. Washington, DC: Teaching Strategies, Inc., 2002.

Meisels, S., D. Marsden, and C. Stetson. Winning ways to learn; Ages 3, 4, and 5. New York: Goddard Press, 2000.

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Websites

Top Ten Common Myths about Math
www.swt.edu/slac/math/skills/12Myths.html

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Supplemental Material

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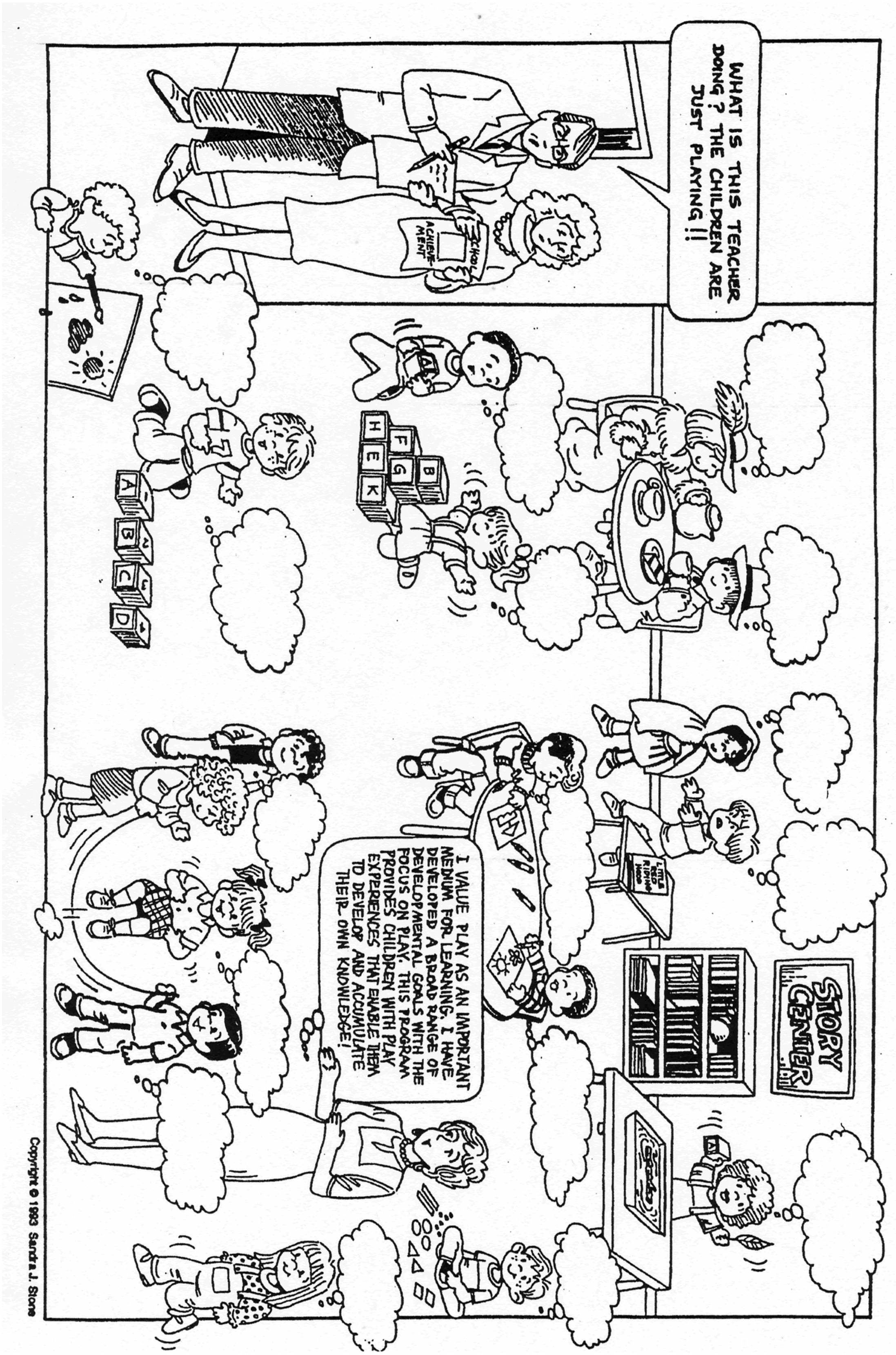
Sandra Stone Cartoon



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